Normalcy in healthcare design: An extension of the natural and built environment

Dr Omniya El Baghdadi, Project Coordinator, Queensland University of Technology[1]
Professor Jenny Ziviani, Children's Allied Health Research, Queensland Health
Katharina Nieberler-Walker, Principal& Head of Landscape Architecture, Conrad Gargett[2]
Dr Angela Reeve, Visiting Researcher, Queensland University of Technology
Associate Professor Cheryl Desha, School of Engineering / Cities Research Institute, Griffith University

Theme: Sustainable development: designing to promote health and biodiversity
Environments that enhance wellbeing and preserve healthy ecosystems

Abstract

The healthcare industry is increasingly adopting integrated care systems in which building design plays a significant role in patient experiences, treatment and wellbeing. People-centred building design builds on several decades of research that demonstrate how certain environments stimulate behavioural, as well as physiological and neurological changes in people conducive to healing and general wellbeing. Importantly, these design considerations for health and wellbeing are typically well aligned with concurrent efforts to increase the sustainability of healthcare facilities.

This paper explores the design of healing gardens in hospitals and how these environments can moderate stress and anxiety for patients and families during potentially traumatic periods. Whilst interest in, and the inclusion of, gardens in hospitals is increasing, there still remain few examples of rigorously researched and evaluated healing gardens that demonstrably contribute to patient experiences and well-being. In particular, there is a need for insight into landscape design that extends the aesthetics and functionality of contemporary hospital design, and attends to the contextualized experience of patients, families and staff. Within this emergent field, there is a need to bring together research and industry to develop evidence-based, integrated design solutions.

The recently opened award winning Lady Cilento Children's Hospital (LCCH) in Brisbane, Australia incorporates 11 healing gardens, the design of which drew extensively on emergent evidence-based research findings about the therapeutic and sustainability properties of integrated gardens. The LCCH building itself was also designed to maximise natural light, and to enable intuitive way-finding to the gardens and throughout the hospital, as complementary means of creating normalcy for patients and reducing stress and confusion. Preliminary evaluation of the LCCH healing gardens provides evidence of how these spaces create a critical sense of 'being away' from the hospital, and reduce stress and anxiety. Monitoring and evaluation of the environmental performance of the gardens additionally provides data on water capture and reuse for irrigation, and temperature regulation through micro-climatic conditions. Whilst further investigations will yield additional, valuable insights, these preliminary investigations provide much needed evidence of design considerations for healing gardens that contribute to both their ability to improve patient experiences and wellbeing, as well as the sustainability of these spaces. The findings of this paper have implications for practice and partnering with academia to inform healing gardens design within the healthcare industry.

[1] Citation: El Baghdadi, O., Ziviani, J., Nieberler-Walker, K., Reeve, A. and Desha, C. (2017) Normalcy in healthcare design: An extension of the natural and built environment. Proceedings in *European Healthcare Design (EHD)*, London, 11-14 June.
[2] Contact: E: knieberlerwalker@conradgargett.com.au; P: +61 7 3229 3555

1 Introduction

The healthcare industry is progressively adopting integrated care systems in which building design plays a significant role in the experiences and well-being of patients, their families and staff. When designed appropriately, people-centred building design can promote healing and general well-being in a context that can otherwise be stressful and at times traumatic (Cooper Marcus, 2007; Desha, Nieberler -Walker and Reeve, 2016). In this paper we explore and expand upon various design considerations to discuss opportunities and precedent for reducing stress and confusion, as well as providing a sense of *normalcy* in what can be a very challenging time for patients, patient families and staff.

Firstly, we present background context on the significance of this research area, describing why integrative healthcare design matters. We then summarise the prominent theories in this area and how they play valuable roles in offering integrated-care to patients, particularly children, and their families. We also explore the impact of socially and environmentally sustainable design features on hospital staff and the built environment, given that the role of green infrastructure on hospital buildings in promoting normalising environments is a topic not yet investigated. We suggest a holistic approach to healthcare design by not only recognising the role of technological advancements and internal configuration, but also the role of healing gardens and the role of the building itself, within the local urban environment.

Although the definition of healing gardens (also termed therapeutic, restorative, or rehabilitative gardens) remains somewhat ambiguous, it is generally agreed that they are nature-oriented spaces designed to provide restorative, therapeutic or rehabilitative potential (**Figure 1**; Söderback, Söderström and Schälander, 2004; Cooper Marcus, 2007). We offer preliminary evidence through the award winning Lady Cilento Children's Hospital in Brisbane, Australia with regards to the role that hospital 'healing gardens' play in offering a sense of 'being away', thus reducing stress and anxiety as well as providing opportunities for patients, their families and even staff to feel '*normal'*. The findings of this paper provide bridges that can enable interdisciplinary collaborations and evidence generation towards healthier and more integrated healthcare design.

Fig 1 Access to nature at close hand at the Lady Cilento Children's Hospital Child Mental Health Gardens. Source: Conrad Gargett, photographer Christopher Frederick Jones

2 Applying design models in healthcare infrastructure

It is readily understood that healthcare goes beyond health practitioner-patient care, and encompasses all aspects of the patient and their family's experience of hospitalisation (Shields et al, 2006). Recognising the needs of patients and their families, as well as hospital staff, is immensely important in providing quality and effective healthcare, where 'a need' is defined as something that is bad for a person to be without (VonWright, 1982).

Generally, hospitalisation is a stressful experience for children. School-age children have fears and concerns regarding illness and hospitalisation. These fears include pain, immobility and mutilation, and when coupled with loss of control and disruptions to normal daily routines these can exacerbate levels of stress in hospitalised children (Barnes et al, 1990; McClowry, 1988; Stevens, 1986; Timmerman, 1983). A recent study by Coyne (2006) in which semi-structured interviews were conducted with hospitalised children identified a range of concerns and fears, including separation from family and friends and being in an unfamiliar environment creating disruption in children's lives. This study also found that some children found it difficult to keep themselves occupied due to inadequate play facilities and limited equipment further making them miss their home life and routines. This makes understanding hospital design and décor central to minimizing such potential difficulties.

Shields et al (2008, p 68) explored the needs of parents of hospitalised children in Australia. They found that '*needs relating to reducing anxiety*' was ranked as important for these parents, as well as '*to have a special place in the unit where parents can be by themselves*'. In the context of family centred care, an approach to health care espoused by most Australian hospitals, ensuring that the needs of the entire family unit are accommodated is considered central to optimal health outcomes for the child.

In addition to patient and family care, often overlooked in health care design are the needs of the providers of care, hospital staff. Attention restoration theory (Kaplan and Kaplan, 1989) recognises that our cognitive capacity may become diminished from constant and arduous directed attention, and can be restored through gazing upon, and immersion in, the natural world through a process of 'soft fascination' or undirected attention. In other words, time away in nature helps re-establish our capacity to pay attention. Another view proposed within stress restoration theory (Grahn and Stigsdotter, 2010) suggests that our physiological and psychological needs may be broadly restored by an experience of nature due to evolved responses that promote behaviours related to seeking out and spending time in safe, fertile natural settings. Offering supportive and restorative environments not only to patients and their families, but to staff members becomes increasingly important to ensure better medical performance and reduced instances of medical errors.

Table 1 summarises four key models and approaches that draw on an emerging understanding of environmental influences on humans for the design of healthcare, and more general, environments to promote healing, health and wellbeing. A hospital's core function is to offer efficient and effective care to patients and the way this care is delivered must be considered within the context of the design, internal configuration and external environment of the hospital. Research in several theoretical fields has indicated that humans are neurologically, physically and emotionally responsive to cues in their surrounding environment (Ulrich, 1984; Kaplan and Kaplan, 1989; Kellert, Heerwagon and Mador, 2008). With particular relevance to healing, the stress response and activation of the sympathetic (and alternatively the parasympathetic) nervous system has been linked to environmental conditions (Bengtsson, 2015). Higher stress levels reduce the body's healing processes (Ulrich et al, 1991), which indicates the potential underlying reason for faster rates of healing that have been found in hospital patients who are exposed to natural environment settings (Ulrich, 1984).

Table 1 Summary of key models in healthcare infrastructure

Key model	Description
Salutogenesis	Salutogenesis considers the precursors and causes of good health, and how to create, enhance and improve mental, physical and social wellbeing (Antonovsky, 1979; Becker, Glascoff and Felts, 2010)
Evidence-based design	Evidence-based design uses research to inform links between the physical environments of facilities to healthcare outcomes provides a foundation for the design of facilities (Ulrich, 2000; Zengul and O'Connor, 2013).
Contextual design	Contextual design is a process fundamentally based on in-depth field research that looks at the whole work and life context of the use of the product or service under consideration, and develops integrated designs that supports the user's activities. The process is fundamentally based on connecting designers intimately with the experiences, needs and preferences of the people who will interact with what they are designing (Beyer and Holtzblatt, 1998).
Family centred design	Family-centred design considers the needs of patients and families across most aspects of healthcare systems, from the physical design of hospitals and facilities, to admission and clinical procedures, to the development and operation of ancillary services such as pharmacies, kids' zones and healing gardens (Bate and Robert, 2006)

3 Case study: Lady Cilento Children's Hospital (Brisbane, Australia)

In this case study the authors reflect on their experiences at the Lady Cilento Children's hospital (LCCH, see **Figure 2**) to highlight how 11 gardens were designed, and the gardens' role in offering a familiar escape from a hospital environment. This includes the value of incorporating various gardens throughout the hospital building to cater for several needs of building occupants and to consistently offer a sense of normal. The authors also draw attention to the importance of context and how a hospital building can positively to the surrounding environment, recognising the value of offering various escapes and opportunities to experience *normal* activities in open and green spaces that are connected to local similar spaces.

Fig 2 Illustration of the 11 healing gardens and community spaces at the Lady Cilento Children's Hospital. Source: Conrad Gargett

In inner-city Brisbane, LCCH is at the forefront of healthcare design innovation, incorporating eleven healing gardens and on-ground community spaces to redefine the look and feel of a hospital. The hospital replaces two former children's hospitals (Mater Children's and Royal Children's Hospital) in Brisbane, bringing together specialist services into a single location. The hospital was designed in a joint-venture partnership between two architecture firms (Conrad Gargett in Brisbane and Lyons in Melbourne), with landscape architects from Conrad Gargett involved in the design process from the initial design. The design of these healing gardens drew on a body of research from multiple disciplines indicating that experiences of nature stimulate neurological, psychological and physiological responses in humans that are conducive to health and wellbeing (Ulrich, 1999; Cooper Marcus, 2007). However as discussed in the previous sections, despite the research indicating that the inclusion of natural features in hospital environments may promote healing with improved patient outcomes and reduced healthcare spending, there has been limited understanding on the role of the gardens in offering a sense of normalcy and familiarity to the occupants of the building. Within this context, the design team for the project proactively engaged in several initiatives to generate robust design outcomes for the healing gardens, as highlighted in the following paragraphs.

3.1 Working to normalise a hospital environment

The LCCH design team sought early on in the project to deliver opportunities for activities that offer occupants an opportunity to escape the sterile and at times confronting experience of hospitals to minimise disruption to everyday life, offering a safer and more relaxed hospital space, particularly for children. A defining factor in achieving these ambitions was the inclusion of the landscape architect design team early; in the planning and design phases of hospital. The hospital building maximises green space with only 25 per cent of the site area covered by conventional roof with the remainder of the side being public open space or roof gardens. Technical aspects such as water proofing, protection, drainage services and growing media were considered early on, thus minimising costs, maintenance and providing inconspicuous infrastructure for the green. These outdoor spaces were purposely designed for various demographics and to cater for several purposes such as recreation for staff, patients and families, therapy space, a pet visiting area, a kitchen garden, and a children's playground.

Inspired by the principles of biophilic urbanism, or nature-loving cities, the landscape architects wanted to create a sense of an 'urban park' in the building, offering a consistent sense of openness as well as an invitation for 'safe observation' and refuge (**Figure 3**). Having 11 gardens throughout the hospital offers various opportunities to access nature as well as natural light. This creates this experience of a park as access to green space is available on various levels of the hospital, which then offers consistent opportunities for motion and a sense of freeness for building occupants to socialise, stroll, reflect or talk in a relaxed environment. These garden spaces are particularly important for long-stay patients, where a simple experience such as smelling freshly cut grass invokes a sense of normalcy and familiarity. The design also borrows from Jay Appleton's theory of *prospect and refuge* which argues that green spaces should ensure opportunities for concealment as well as refuge to appeal to various garden users, and in turn multiple the benefits of the space, through 'safe observation' (Appleton, 1986). For example, the secret garden on Level 5 (**Figure 4**) is publicly accessible and has been designed for contemplation, recreation and an escape from the internal hospital environment. The overnight parents' retreat is close to the secret garden, providing a calming retreat in difficult and often stressful times.

A children's playground adjacent to the community plaza incorporates play elements such as a bower bird's nest, making tangible and whimsical reference to native animals to inspire children and connect them to familiar wildlife. The adventure garden on Level 6 enables rehabilitation activities complementary to internal rehabilitation facilities and includes a climbing wall, trampoline, basketball hoop and wheel chair training ramp. These rehabilitation facilities have been designed to improve coordination, build strength and, above all, provide hope for the future. The multi-purpose design of this garden has been designed to also cater for fundraising events. The staff garden on level 7 is available to doctors, nurses and administrative staff and has been located outside internal recreation spaces including food preparation areas. Staff retention and satisfaction is a high priority at the hospital. Escape from an often stressful work environment to a special roof garden allows staff an opportunity to relax and disconnect from work (Ulrich, 2000).

Fig 3 Children experiencing the green sloping wall in the adventure garden on level 6. Source: Conrad Gargett, photographer Christopher Frederick Jones

Fig 4 Garden users find refuge in the secret garden on level 5. Source: Conrad Gargett, photographer Christopher Frederick Jones

The Child Youth Mental Health Services gardens (CYMHS) on Level 8 (**Figure 5**) are specifically designed for small children, adolescents and high care patients, to help lift the spirit and improve mood. While there is a need to minimise opportunities for self-harm, there is also a desire to support basic human needs and individuality and create an outdoor environment that is respectful of these. The security fence for the CHYMS gardens is 4.25m tall and angled to ensure it cannot be scaled. The adolescent garden includes a grass mound as a vantage point to look out over the city, observe the night sky or watch outdoor movies. The high care unit provides a green outlook, intended to help calm the mind and gently stimulate the senses.

Fig 5 Epiphyte columns – an innovative way of including green in the Child Mental Health Gardens on level 8. Source: Conrad Gargett, photographer Christopher Frederick Jones

Appreciating the location of the hospital building is also important when considering mechanisms to create a sense of normalcy and familiarity for building occupants. This hospital design took this into consideration, recognising that the hospital building is in fact an extension and complimentary to the surrounding context (**Figure 6**). The secondary hospital entry off Graham Street and the community plaza face Southbank Parklands, the Brisbane River and the central business district. Recognising this, the hospital building serves as an extension to the surrounding environment – to compliment the context in which it resides. The purple and green colours on the building façade reference the popular jacaranda trees spectacular when in flower in nearby Southbank Parklands and in Brisbane in general. The new community space in front of the hospital hosts green canopies with six 30-year old figs to form an entry portal to the hospital precinct and provide natural shade and a green outlook from the hospital. The figs are a contextual reference to subtropical Brisbane and to the groups of figs close by in Memorial Park and Aubigny Place. The figs are intended to provide scale and assist in integrating the new building and community places into the existing context.

Fig 6 Designed to connect to neighbouring institutions and community - the community plaza at the Lady Cilento Children's hospital. Source: Conrad Gargett, photographer Christopher Frederick Jones

3.2 End-user feedback – Semi-structured interviews

The starting point for integrated-care systems is to understand more fully the associations and the underlying causality between healthcare design and occupant experience. Preliminary results from a research study that is currently underway highlights the importance of offering patients a sense of normalcy in a hospital environment (Catapult Project: LCCH, Queensland University of Technology - QUT Ethics Approval: 1600000373; LCCH Ethics Approval: HREC/16/QRCH/249). This research project documents reflections and insights, providing additional context to the information provided from the LCCH case study (above) and literature in the field that considers design approaches and operation of healing gardens in hospital environments, Brisbane and sub-tropic regions. Detailed analysis of the findings is currently underway for future journal publication, considering the optimisation of green space in LCCH, at other healthcare facilities and implications for biophilic urbanism (nature loving cities) research. Preliminary findings are used in the following paragraphs where it informs the normalcy discussion.

A series of 12 semi-structured interviews with Allied Health practitioners (March-April 2017) have highlighted for the researchers how the gardens offer patients as well as their families a space to escape the hospital environment, which can often feel sterile and disconnected, and instead offer them a sense of connection and normalcy.

"A lot of the Oncology children their treatment is very long so their time in hospital can be very heavy, but also the time is very lengthy. So the garden plays a very important role in normalising everything that is going on in their life. I found that especially with one boy that was 13 years old and the garden was a place where he felt normal. He was outside in the air, he could feel the sun and that's where it plays an important role in making them feel like a normal person again." Physiotherapist, LCCH

"One of the things that I have seen is a huge shift in mood and the relationship that you can build with them as well. They are very used to meeting so many different people that they develop a stronger

relationship with you because you take them to do more normal things – being outside in the garden and it is better for your mood. I feel better too." Physiotherapist, LCCH

Allied Health practitioners really valued the garden space and recognised the benefits it offered their patients in giving them a sense of calm and normalcy. They expressed the ease it provided them and how that, in turn, facilitated the therapy session to run smoothly. Additionally, they understood that children do not want to be in a hospital – these gardens physically remove them from a hospital environment, and for the duration of the therapy session, they are able to feel like children again. This, they expressed, was essential in accelerating healing rates and responsiveness to therapy.

"*These children are a part of a great family unit, especially when you are in hospital for a long period of time and you have had an acute definite change in function you need a time to grieve as a family and be as a family and you need a space to be able to do that."* Occupational therapist, LCCH

This participant expressed how the outdoor space is not only of great value to patients, but also for families who are undeniably a part of the treatment process - offering them a space to collectively cope with a change in the family is necessary.

3.3 End-user feedback – Bench diary reflections

In addition to the semi-structured interviews, a series of 10 visitors' books, or *bench diaries*, were left on bench seats in the gardens over several weeks (January – March 2017) to capture personal and unbiased reflections of experiences of the gardens. This exercise was a replicate of a previous bench-diaries study undertaken in 2015 at the LCCH (Reeve, Nieberler-Walker and Desha, *In Press*). It captured various entries such as notes, letters, poetry and drawings by patients, families and even staff members. In particular, some of the entries highlighted how the gardens offered that sense of peace, as they offered a break from the hospital environment (**Figure 7**).

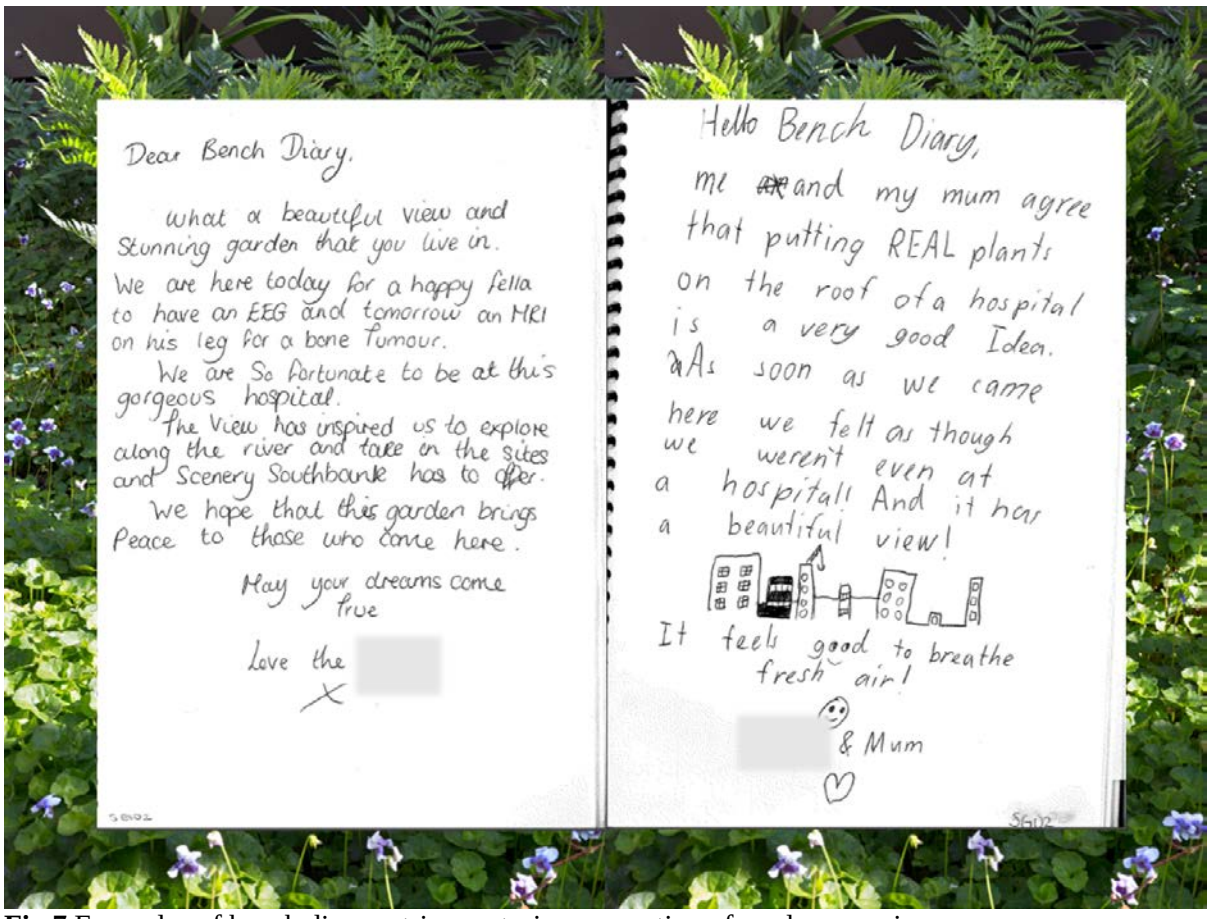

Fig 7 Examples of bench diary entries capturing perception of garden experience

The bench diary experiential accounts, by patients, families and staff of the Lady Cilento Children's Hospital, clearly highlight the role of the gardens in offering a sense of normalcy and peacefulness. This includes assisting them with shifting perspectives and taking a break from the reality of their current situation. The diary entries in the images demonstrates appreciation of the outdoor space, as well as the fresh air and the views – and how this offers a different, more comforting perspective from the illness they are experiencing. We are offered unbiased insights into the thoughts and feelings of patients and their families into their hospital experience and the impact of having access to an outdoor space. For instance, in the image on the left, the diary entry points to the fascination with feeling 'as though we weren't at a hospital'. This account from what appears to be a child visiting the hospital with their mother serves as an important insight into how the gardens can, in fact, play a role in perpetuating this notion of normalcy in a hospital environment. The image on the right showcases a family's feeling of being connected to the surrounding environment, which again could offer a sense of familiarity within a hospital setting. The following section will distil the concepts discussed in the case study and preliminary findings to offer a set of emergent principles for implementing normalcy in healthcare design.

4 Emerging principles for implementing 'normalcy'

In the following paragraphs we present and briefly discuss six emergent principles to aid normalcy and familiarity for building occupants and the community. The prominent design approaches examined and the successful example of the Lady Cilento Children's Hospital provide a context to discuss what can be achieved with regard to integrating features of biophilic design to aid in *normalising* the look and feel of healthcare design for patients, families and even staff members. Furthermore, recognising that a hospital building is part of the urban fabric means recognising mechanism to maximise its role and potential in the built environment to go beyond and even positively contribute to the built environment. As illustrated in **Figure 8**, any enhancement in the hospital building, creates a rippling positive affect in urban environment, explicitly or implicitly (el Baghdadi, 2016) – whether economic (better staff retention, reduced absenteeism, better patient care i.e. quick bed turnover), socially (reduced stress for all occupants); environmentally (improved microclimate for urban comfort and increase in biodiversity).

Fig 8 The secret garden at the Lady Cilento is designed to enhance wellbeing and enjoyment. Source: Conrad Gargett, photographer Christopher Frederick Jones

Critical questions arise from considering how one would implement the notion of 'normalising' a hospital building. The literature summarised above and the case study explored have highlighted emerging principles for implementing 'normalcy' in healthcare design. These depict the need to reconnect people to familiar experiences from their everyday life. Appreciating that any design process is an iterative non-linear process, designers can revisit these principles to keep drawing inspiration for concepts and notions that are conducive to normalcy and familiarity.

***Consider location and context*:** A hospital building should recognise the local context to act as a natural and a seamless extension of the surrounding environment. This reduces the sudden disruption for building occupants and instead invokes a sense of ease and calm. The process of designing is a creative and an intelligent process and the outcome can either positively or negatively affect the experience of a place. Good design recognises the need to design spaces that pertain to the surrounding environment, climate, culture and people. This requires recognising the collective experience encountered by occupants and even communities to create spaces that feels familiar to the location and context of which, in this case, a hospital building resides.

Link indoor-outdoor: Linking the indoor hospital environment to the outdoor hospital environment further adds to this notion of normalcy. It becomes necessary to understand this notion of co-location of hospital programs inside and outside to consider incorporating areas for play, learning, recreation, rehabilitation and therapy that is essential for family-centred design. This also includes physical and social connection to neighbouring institutions and facilities. Feeling this connection to the external environment allows building occupants to still feel connected to what is familiar and normal, such as in the LCCH example, Southbank and the Brisbane River.

Design for prospect and refuge: Landscape settings need to be considered carefully and be open and inviting with opportunities for 'safe' observation. This applies Jay Appleton's theory of 'prospect and refuge' (Appleton, 1986). His theory argues that an open landscape with opportunities for concealment as well as prospect is most beneficial to people's survival, and in our case for enjoyment and use. Healing garden design synthesises the intent, context and beauty of the natural world for the benefits of patients, their families and staff to feel safe and at ease with the space.

Integrate adequate green and open spaces: Some studies have suggested that gardens provide a restorative setting where patients, their families and hospital staff find reprieve from the stressful environment of hospital wards (Cooper Marcus and Barnes, 1999; Whitehouse et al., 2001; Sherman et al., 2005). Contributing to this stress-reducing potential, gardens have also been found to foster social connection, a sense of escape and of control and a sense of normalcy (Reeve, Nieberler-Walker and Desha, in press; Ulrich, 1999). As discussed in the case study above, ample access to green and open spaces has been favourable amongst patients, families and staff.

Stimulate all senses: Incorporating design features that inspire the senses becomes important in creating familiarity in an unfamiliar hospital environment. Gardens should provide a multi-sensory experience, in particular through the combination of diverse and attractive visual stimuli and 'views', being located outdoors with 'fresh air', which may stimulate the olfactory (among other) sense, as well as having sunshine and warmth on the skin (touch). These comments appear resonant with Attention Restoration Theory (Kaplan, 1995; Kaplan and Kaplan, 1989), in particular that garden users note that the views and garden helps to 'open up the mind', to 'refresh' and provide 'focus' after time in the hospital.

Cater for a variety of activities: Adding to this notion of normalising, comfortable places for socialising and time out satisfy various occupant activities. The LCCH gardens were designed considering options for various needs such as physical activities, an outdoor kitchen area and an opportunity to engage in various games. The goal is to combine priorities for the functionality or performance of the systems (i.e. activities to cater to various needs), with the safety or engineering aspects (i.e. how safe, well designed and reliable is the system), with the aesthetics of experience (i.e. how the whole interaction with the service feels or is experienced) (Bate and Robert, 2006).

5 Conclusion and Implications for the healthcare industry

Hospitals around the world are aspiring to be a symbol of health, not just for patients, but also for the built environment. In terms of good corporate social responsibility, hospitals need to feel as 'normal' as possible, and include incorporating green spaces that aid wellness beyond the hospital walls. In this paper the authors have discussed relevant literature and described key findings from a study into the end-user experiences of the Lady Cilento Children's hospital, to promote well-being in patient care. We anticipate that our findings will be useful to landscape architects, designers and healthcare professionals around the world.

Specifically, this paper presented six emergent principles from the literature and the LCCH case study, that can be used to guide healing garden design, reducing disruption to patients and their families as much as practically possible:

- Consider location and context
- Link indoor-outdoor
- Design for prospect and refuge
- Integrate adequate green and open space
- Stimulate all senses
- Cater for a variety of activities

These design principles provide practical strategies to reconnect building occupants to familiar experiences to promote health and well-being.

Arising from this study are various factors for further research including the extent to which we need to implement these principles, and identifying specific sub-elements within each principle. Additionally, recognising the potential effect of differing cultural contexts for hospital healthcare should also be explored to understand how culture impacts healthcare design. Understanding these factors will help minimise barriers to mainstreaming this emergent notion of incorporating these *normalising* principles to healthcare design.

Looking ahead the learnings from the LCCH study will contribute to an improved understanding of the needs of patients, their families and staff and will help to better understand and articulate design processes for healing gardens. Ultimately the authors intend to broaden collaboration to include green infrastructure in care facilities such as hospitals, community care, childcare, education and senior living.

References

Antonovsky, A. (1979). *Health, Stress, and Coping*: Jossey-Bass.

Appleton, J. (1986). The Experience of Landscape. New York: John Wiley and Sons.

Barnes, C.M., Bandak, A.G. and Beardslee, C.I. (1990) 'Content Analysis of 186 Descriptive Case Studies of Hospitalised Children', Maternal–Child Nursing Journal 19(2): 281-96.

Bate SP and Robert G. (2006). 'Experience-based design: from redesigning the system around the patient to co-designing services with the patient'. Quality & Safety in Health Care, 15(5) 307–10.

Becker, C. M., Glascoff, M. A., & Felts, W. M. (2010). Salutogenesis 30 Years Later: Where do we go from here?. Global Journal of Health Education and Promotion, 13(1).

Bengtsson, A. (2015). From experiences of the outdoors to the design of healthcare environments. 2015(66).

Beyer, H. and Holtzblatt, K (1998) Contextual design: defining customer-centered systems, Morgan Kaufmann Publishers Inc., San Francisco, CA.

Cooper Marcus, C. (2007). Healing gardens in hospitals. Interdisciplinary Design and Research e-Journal, 1(1), 1-27.

Cooper Marcus, C., & Barnes, M. (1999). Healing gardens: Therapeutic benefits and design recommendations: John Wiley & Sons.

Coyne, I. (2006) Children's experiences of hospitalization. Journal of Child Health Care. 10, 4, 326-336.

Desha, C., Nieberler-Walker, K., & Reeve, A. (2016). Healing gardens: Hospital design using nature to heal and soothe. Retrieved from http://landscapeaustralia.com/articles/healing-gardens-hospital-design-using-nature-to-heal-and-soothe/#object-credits

el-Baghdadi, O. & Desha, C. (2016) Conceptualising a biophilic services model for urban areas. Urban Forestry and Urban Greening. (In Press)

Grahn, P., & Stigsdotter, U. K. (2010). The relation between perceived sensory dimensions of urban green space and stress restoration. Landscape and Urban Planning, 94(3–4), 264-275.

Kaplan, S. (1995). The restorative benefits of nature: Toward an integrative framework. Journal of Environmental Psychology, 15, 169-182

Kaplan, S., & Kaplan, R. (1989). The Experience of Nature: A Psychological Perspective: Cambridge University Press.

Kellert, S. R., Heerwagen, J., & Mador, M. (2008). Biophilic Design: The Theory, Science and Practice of Bringing Buildings to Life: Wiley.

McClowry, S.G. (1988) 'A Review of the Literature Pertaining to the Psychosocial Responses of School–aged Children to Hospitalization', Journal of Paediatric Nursing 3(5): 296–311.

Reeve, A., Nieberler-Walker, K. and Desha, C. (In Press) 'Healing Gardens in Children's Hospitals: Reflections on Benefits, Preferences and Design from Visitors' Books', in J. Urban Forestry and Urban Greening, Elsevier.

Sherman, S. A., Varni, J. W., Ulrich, R. S., & Malcarne, V. L. (2005). Post-occupancy evaluation of healing gardens in a pediatric cancer center. Landscape and Urban Planning, 73(2), 167-183.

Shields, L., Pratt, J. & Hunter, J. (2006). Family-centred care: a review of qualitative studies. Journal of Clinical Nursing 15 (10)1317-1323.

Shields, L., Young, J, and McCann, D. (2008). The needs of parents of hospitalised children in Australia. Journal of Child Health Care 12 (1): 60-75.

Söderback, I., Söderström, M., & Schälander, E. (2004). Horticultural therapy: the 'healing garden 'and gardening in rehabilitation measures at Danderyd Hospital Rehabilitation Clinic, Sweden. Pediatric rehabilitation, 7(4), 245-260.

Stevens, M. (1986) 'Adolescents' Perception of Stressful Events during Hospitalisation', Journal of Pediatric Nursing 1(5): 303–313.

Timmerman, R.R. (1983) 'Preoperative Fears of Older Children', Association of operating Room Nurses Journal 38: 827-34.

Ulrich, R. S. (1984). View through a window may influence recovery. Science, 224(4647), 224-225.

Ulrich, R. S. (1999). Effects of Gardens on Health Outcomes: Theory and Research. In C. Cooper Marcus & M. Barnes (Eds.), Healing Gardens - Therapeutic Benefits and Design Recommendations (pp. 27-86): John Wiley and Sons

Ulrich, R. S. (2000). Evidence based environmental design for improving medical outcomes. Paper presented at the Proceedings of the Healing by Design: Building for Health Care in the 21st Century Conference, Montreal, Quebec, Canada.

Ulrich, R. S., Simons, R. F., Losito, B. D., Fiorito, E., Miles, M. A., & Zelson, M. (1991). Stress recovery during exposure to natural and urban environments. Journal of Environmental Psychology, 11(3), 201-230.

VonWright, H. (1982) 'Om Behov. Filosofisk Tidskrift ('About Needs'), Philosophical Periodical. 3:1-12.

Whitehouse, S., Varni, J. W., Seid, M., Cooper-Marcus, C., Ensberg, M. J., Jacobs, J. R., & Mehlenbeck, R. S. (2001). Evaluating a children's hospital garden environment: Utilization and consumer satisfaction. Journal of environmental psychology, 21(3), 301-314.

Zengul, F. D. and O'Connor, S. J. (2013). "A Review of Evidence Based Design in Healthcare from Resource-Based Perspective," Journal of Management Policy and Practice, 14(2), 19 – 36.